## Controlled Release of Drugs:

Polymers and Aggregate Systems

Edited by Morton Rosoff



## **CONTENTS**

CHAPTER 1	
MODELING OF DRUG RELEASE FROM POROUS POLYMERS	j
Ronald A. Siegel	
<ul> <li>I. Introduction 1</li> <li>II. Drug Flow through and from Macroporous Hydrophobic Polymers 2</li> <li>III. Effect of Pore Structure on Diffusion Rates 13</li> <li>IV. Microporous Systems 40</li> <li>V. Macroporous Systems Where the Polymer Is Hydrophilic VI. Conclusion 49</li> </ul>	46
CHAPTER 2	
BIODEGRADABLE POLYMERS FOR CONTROLLED RELEASE OF DRUGS	<i>5</i> .
Robert J. Linhardt	•
<ul> <li>I. Introduction 53</li> <li>II. Modes of Polymer Erosion and Drug Release 57</li> <li>III. Biodegradable Polymers 69</li> <li>IV. Formulation, Administration, and Evaluation 73</li> <li>V. Survey of Biodegradable Polymers in Drug Delivery 77</li> </ul>	
CHAPTER 3	),
DISPERSED SYSTEMS FOR PARENTERAL ADMINISTRATION	97
Curt Thies	
I. Types of Targeting 97  II. Types of Carrier Systems 98  III. Requirements of Parenteral Drug Delivery Systems 99  IV. Materials for Fabricating Particulate Drug Carriers 100  V. Formation of Dispersed Systems 105  VI. Liposomes 113  VII. Niosomes: Nonionic Surfactant Vesicles 114  VIII. Loaded Erythrocytes 115	4 <b>5</b>
IX. Parenteral Emulsions 116	
X. Nanoparticles 117 XI. Summary Comments 119	ì

CHAPTER 4 LIQUID CRYSTALS AND THEIR APPLICATIONS IN DRUG DELIVERY	125
Praveen Tyle	
<ul> <li>I. Introduction 125</li> <li>II. Classification of Liquid Crystals 126</li> <li>III. Emulsifier—Emulsifier Association 133</li> <li>IV. Role in Stability of Formulations 144</li> <li>V. Applications in Controlled Drug Delivery 156</li> </ul>	
CHAPTER 5	
MULTIPLE w/o/w EMULSIONS AS DRUG VEHICLES	163
A. T. Florence, J. A. Omotosho, and T. L. Whateley	
<ul> <li>I. Introduction 163</li> <li>II. Composition of the Multiple Emulsion and Stability: Influence of the Nature of Oil Phase 165</li> <li>III. Methods Available for Stabilizing w/o/w Multiple Emulsions 166</li> <li>IV. Mechanisms of Transport of Solutes 172</li> <li>V. In Vivo Studies 176</li> </ul>	
CHAPTER 6	
MICROEMULSIONS: AN EVOLVING TECHNOLOGY FOR PHARMACEUTICAL APPLICATIONS	185
Roger Leung and Dinesh O. Shah	
<ul> <li>I. Introduction 185</li> <li>II. Structure of Microemulsions 192</li> <li>III. Solubilization and Formulation of Microemulsions 200</li> <li>IV. Transport Properties and Pharmaceutical Applications of Microemulsions 209</li> </ul>	
CHAPTER 7	
COMMERCIAL APPROACHES TO THE DELIVERY OF MACROMOLECULAR DRUGS WITH LIPOSOMES	217
Alan L. Weiner, John B. Cannon, and Praveen Tyle	
<ul> <li>I. Introduction 217</li> <li>II. Materials for Preparation 219</li> <li>III. Processes for Liposome Manufacture 222</li> <li>IV. Sustained Drug Delivery from Liposomes 236</li> <li>V. Specific Applications of Liposomes for Delivery of</li> </ul>	

Macromolecules 243

	LEIC ACIDS IN REVERSE MICELLES	255
Battis	tel Ezio, Imre Ergin Velin, and Luisi Pier Luigi	
I.	Introduction 256	
II.	Experimental Procedures 257	
III.	Results 258	
IV.	Discussion 272	
CHAI	PTER 9	
TRAI	NSDERMAL DRUG DELIVERY SYSTEMS	277
Richa	rd Baker and Frank Kochinke	
I.	Introduction 277	
II.	Device Design 278	
III.	Skin or Device Rate Control 283	
IV.	Skin Depot Effects 287	
V.	Skin Permeability: Published Data Reliability 291	
VI.	Skin Permeability Measurements 293	
VII.	Prediction of Skin Permeability 298	
VIII.	Skin Permeation Enhancement 299	
IX.	Conclusions 303	

χi

*307* 

**CONTENTS** 

CHAPTER 8

**INDEX**